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ABSTRACT

Observing that most adults' present conceptions of the computer have been shaped by media images, a content analysis was conducted of 169 articles on computers published in six popular magazines from the 1940s through 1969. The articles were coded in terms of their themes and topics, and the specific terms used to refer to computers in each article were listed, as were metaphors or analogies that involved anthropomorphosis, or the attribution of human characteristics to computers. The results indicated that the largest number of articles were published between 1965 and 1969, and between 1975 and 1979. The major focus of the articles began with developments and advances in computer technology and changed over time to uses and predicted uses of the computer. Military uses were the most frequently mentioned during the first 20 years, but this was replaced by mention of the business/industrial sector, which was subsequently replaced by academic uses. References to the limitations, advantages, or similarities of computers versus human beings decreased rather steadily over the period studied, as did the number of different terms used to refer to the computer. Anthropomorphic similes and metaphors describing computers were used sporadically throughout the time period studied. (HTH)

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TRENDS IN POPULAR MAGAZINE DEPICTIONS OF THE COMPUTER

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INTRODUCTION

The computer has become the key element in what is perhaps the most significant communications revolution since the development of the printing press. Many adults, however, still find these devices mysterious and intimidating. This may be due in part to the rapidity with which this new technology has become diffused throughout our culture, before most people have had time to develop a clear understanding of its nature. However, although most adults today have had little personal experience with computers until very recently, they have been exposed to mass media depictions of computers since at least the 1940's, in newspapers, magazines, books, films, radio, and television. Thus, most adults' present conceptions of the computer have to some extent been shaped by the descriptions, definitions, and images of computers presented in both factual and fictional mass media content. A systematic study of mass media depictions of computers could help to reveal some of the bases for people's current beliefs and feelings about these devices as well as provide an indication of how our culture's conceptions of the computer may have changed over time.

The processes through which our conceptions of social reality develop are most apparent in the case of those aspects of reality

which, due to their novelty or controversial nature, have not yet been clearly defined. The computer would seem to be just such a novel and as yet somewhat confusing aspect of reality, and a study of the mass media's contributions to the general public's beliefs and assumptions about computers promises to provide valuable insights into a basic but normally opaque social process. At the same time, the computer is itself a powerful communication medium which will inevitably alter our social reality in fundamental but unpredictable ways. A better understanding of our conceptions of the computer and the possible bases for these conceptions is thus not only a subject of considerable theoretical interest but also potentially one of great social significance and utility as well.

In terms of its relationship to public conceptions and beliefs, mass media content must be viewed as both a dependent and independent variable. That is, while mass media content intended to be "factual" in nature can to a certain extent be seen as a reflection of already-existing beliefs and conceptions widely shared throughout the culture, this reflection is necessarily both selective, in that not all public beliefs can be reflected with equal frequency and emphasis, and further shaped by the needs and exigencies of the mass media as organizations and institutions. In this paper, mass media content is examined from both these perspectives, as a significant indicator of certain patterns of beliefs and viewpoints within the culture, and thus

as a factor in the reinforcement and further dissemination of these beliefs and viewpoints, and also as a contributory factor in the development of people's beliefs and conceptions about a novel aspect of their physical and social environment.

METHODOLOGY

The methodology employed in this study consisted of a content analysis, both quantitative and qualitative, of material dealing with computers in one type of media source, popular magazines, from the 1940's to the present. Using the Readers Guide to Periodical Literature, all articles about computers published in Time, Newsweek, Life, Look, Saturday Evening Post, and Readers Digest magazines from 1943, the year the first such articles were listed in the Readers Guide, through 1981, were identified and collected. Popular magazines seemed an appropriate source to examine since their contents have been indexed and are easily accessible. The particular magazines included were selected on the basis of their appeal to a general audience of readers, rather than to specific demographic subgroups or to those especially interested in technical or scientific matters.

While the number of computer-related articles published each year in the selected magazines has been tabulated for the entire

time period under study, only those articles published through 1969 have as yet been coded [1]. Of the 172 articles about computers listed by Readers Guide from 1943 through 1969 in the magazines selected for study, 160, or 93% of the total, have been located and analyzed. The length of each article was determined [2], and each was coded for its main focus as well as for other major topics or themes mentioned, including the following: types of actual and intended uses or applications of computer technology (e.g., ballistics measurements, weather forecasting, manufacturing, accounting, teaching, etc.); locus of actual or intended use (e.g., the military, government, schools, home); advances in computer technology (e.g., improvements in memory devices, miniaturization, voice synthesis, development of silicon chips, etc.); explanations of how computers work; references to the size or cost of computers, and whether these were relatively large or small; business developments in the domestic computer industry, and whether these were positive or negative; foreign

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1. A later paper will cover the subsequent decade and a half. This project is envisioned as the first stage of a larger content analysis study which will eventually encompass relevant material from a wide range of mass media sources.

2. Articles were categorized as "short," "long," and "major," according to the following criteria: Those articles 2 columns or less long in Time and Newsweek magazines and 3 pages or less in length in Readers Digest, Life, Look, and Saturday Evening Post were considered "short;" those 3 to 6 columns long in the newsmagazines and 4 to 6 pages long in the other magazines were categorized as "long;" and articles that were 7 or more columns long in the newsmagazines and 7 or more pages long in the other magazines were categorized as "major."

trade or foreign developments in computer technology; problems related to computers (e.g., lack of trained programmers, inadequate software, computer errors, invasion of privacy, computer crime, etc.); predictions about future advances in computer technology; predictions about the future social impact of computers, and whether this would be positive or negative; the computer's advantages in comparison to the capabilities of humans; the computer's limitations in comparison to the capabilities of humans; and similarities between computers and humans. An additional category was found necessary for coding the major focus of some articles, that of a general, comprehensive overview encompassing the history of the computer's development, explanations of how computers work, the many uses of computers, the social impact of computers, and so on. Once a judgment had been made about the major focus of each article studied, it was further coded for the inclusion of references to any of the other listed topics, without regard for the length of each reference.

Besides coding the articles in terms of their themes and topics, the specific terms used to refer to computers in each article were also listed, as were any metaphors or analogies that involved anthrophomorphosis or the attribution of human characteristics to computers. These data were subjected to a more qualitative examination than that applied to the other portions of the study.

The coding scheme was designed to provide answers to questions such as the following: What capabilities have been attributed to the computer? What possible dangers or problems have been attributed to it? Which of these -- the capabilities or the dangers -- have been given the most emphasis at various points in time? What predictions were made about this technology and its likely social impact? What terms and images and what analogies and metaphors have been used in reference to computers, and how have these changed over time?

FINDINGS

Topics and Themes

Unsurprisingly, the number of articles about computers increased rather steadily from 1943, when one such article was first published in one of the general interest magazines covered in this study, to 1981, when 24 computer-related articles were published in these magazines. Dividing the time period examined into five-year intervals, 2 articles appeared in the period from 1940 through 1944, 18 between 1945 and 1949, 24 from 1950-1954, 22 from 1955-1959, 39 from 1960-1964, 67 from 1965-1969, 53 from 1970-1974, 68 from 1975-1979, and 38 in the years 1980 and 1981 alone, the last years for which data were collected. The largest

jumps in number occurred in the years 1954, 1968, and 1979. Between 1943 and 1969, the period for which articles have as yet been coded, the relative length of computer-related articles also increased somewhat, with the percentage of "major" articles rising from none between 1940 and 1949, to 5% of all articles from 1950 to 1959, to 10% between 1960 to 1969.

The major foci of the articles became increasingly varied over the course of time. By dividing the number of different main topics represented during each five year period, beginning in 1940, by the total number of articles for that period, a measure of main topic diversity was computed, such that the lower the resulting figure, the greater the relative diversity of main topics presented during that time span. While this diversity measure came to .50 for the period 1940-1944 (when only 2 articles about computers had appeared), it had fallen to .20 by 1965-1969, with some fluctuations during the intervening years.

The topic that served as the most frequent major focus of these articles for the first 20 years studied, from 1940 through 1959, was that of developments and advances in computer technology. However, the relative preponderance of this topic as a major focus decreased over this 20-year period, from serving as the major focus of both of the two articles published from 1940-1944, to 72% of those from 1945-1949, to 26% from 1950-1954 (along with uses of the computer, which also served as the major focus of 26% of the articles published during this interval), and then rose

slightly to 32% of all articles for 1955-1959. In the next five-year period, 1960-1964, the topic of technological advances (the main focus of 13% of all articles) was superceded by the uses of the computer (36%) as the most frequent major focus. By 1965-1969, technological advances served as the major focus of only 2% of all articles, while uses of the computer rose to serving as the major focus of 42% of all articles published during that period.

Beginning in 1945, about 7 out of 10 articles during each five-year period referred to the uses to which computers were being put. Again, a measure of the diversity of different uses mentioned during each five-year period was computed by dividing the number of different uses mentioned by the total number of articles referring to this topic. In this case, an increase in diversity of uses would result in a higher figure. This measure of diversity increased steadily from .46 for 1945-1949 (uses of the computer were not mentioned before this time) to 2.04 for 1960-1964. It then dropped to 1.00 for the period 1965-1969. Another measure of diversity would be the number of different uses of the computer mentioned per article. The highest number of such references per article, 3.1, occurred during the period 1955-1959. Thus, it would seem that the 10-year period from 1955-1964 was characterized by the greatest diversity of computer applications mentioned in the magazine articles analyzed.

Ballistics measurements, such as the computing of trajectories

for shells and missiles, was the most frequently mentioned use to which computers were being put in those articles published during 1945-1949 (.77 of all articles referring to the computer's uses) and 1945-1949 (.40 of all relevant articles). In the 1955-1959 period, weather forecasting became the most frequently mentioned use (in 45% of all relevant articles), followed by automated manufacturing for the period 1960-1964 (mentioned in 14% of all articles, which referred to a great number of different uses at this time, as noted above). While the number of different uses mentioned per article had dropped to 1.6 by 1965-1969, the particular uses mentioned changed so much from one article to the next that no one use predominated. By this time, articles were referring to the use of computers for aviation guidance, weather forecasting, accounting, issuing bills and checks, checking income tax returns, automatic ticketing, medical diagnosis, training and instruction, creating art, poetry, and music, and computer dating, to mention only a few of the many applications noted. Interestingly, during the period from 1955 through 1959, when weather forecasting was the most frequently mentioned use of computers, one of the two second-most frequently mentioned uses was for creating a concordance for the Bible (mentioned in 27% of the articles, as was computerized accounting).

The proportion of all articles referring to <u>predicted</u> uses of the computer during the years studied, went from 50% in 1940-1944 (1 of the 2 articles published), to a high of 72% of all the

articles appearing during 1945-1949, after which it decreased steadily, until only 7% of the articles for the 1965-1969 period referred to this topic. However, though the proportion of all articles mentioning predicted uses of the computer decreased, the diversity of different uses predicted actually increased during the same time period. Using the same measures of diversity described above in relation to actual uses of the computer, the ratio of different predicted uses to number of articles rose steadily from 1.00 in 1940-1944 to 2.25 by 1965-1969, while the number of different predicted uses mentioned per article peaked at 2.7 in 1955-1959. The one article from 1940-1944 that mentioned any predicted uses of the computer referred to its use in astronomy research. Weather forecasting was the most frequent predicted use during 1950-1954 (32% of relevant articles) and 1955-1959 (60% of relevant articles), after which so many different predicted uses began to be mentioned that no one predicted use predominated. For example, in the period 1955-1959, manufacturing, accounting, legal research, and composing music were each mentioned in 33% of all articles referring to predicted uses of the computer.

In line with the early emphasis on ballistics research as a commonly mentioned use of computer technology, the most frequently mentioned actual locus of use for computers for the 20-year period from 1940 through 1959 was the military. In 1960-1964, the business or industrial sector became the most

frequently mentioned locus, followed by the (nonmilitary) government sector, with the military mentioned as locus only 5% of the time. During the succeeding 5-year period, from 1965-1969, schools and colleges were the most frequent locus of use, followed by business/industry and government. This was also the period during which the home was first mentioned as an actual locus of computer use (in one article in Time magazine, 1966).

While from 51% (in 1960-1964) to 100% (in 1940-1944) of all articles referred to actual loci of computer use, a far smaller percentage of articles mentioned predicted loci of use. Except for the period 1945-1949, when 50% of all the coded articles referred to predicted loci, this topic was mentioned in only 3% to 14% of all the articles appearing during the subsequent years studied (neither of the 2 articles for 1940-1944 made such references). Beginning in 1945-1949, the most frequently mentioned predicted loci for each five year period were science, business/industry, business/industry, business/industry, and schools/colleges. During the last 5-year period studied, 1965-1969, one article first mentioned the home as a predicted locus of computer use.

Just as developments and advances in computer technology decreased as the major focus of computer-related articles during the time period studied, references to technological developments in the articles studied also appeared less frequently over time, dropping from a high of 100% (both articles) for 1940-1944 and

78% of all articles from 1945-1949, to only 3% of those articles published from 1965-1969. Predictions of future developments in computer technology increased slightly over time, from 6% of all articles in 1945-1949 to 12% in 1965-1969. Explanations of how computers work decreased from a peak of 42% of all articles appearing during 1950-1954, when articles representing general overviews of the development, nature, and uses of computers also reached a high point (21% of all articles), to only 3% of all articles for 1965-1969.

References to business developments in the computer industry increased in frequency, from 6% of all articles between 1945-1949, to 28% by 1965-1969. Through 1959, all such references were clearly positive; in 1960-1964, neutral references outnumbered positive references by 2 to 1; and the first negative business developments, mentioned in 1965-1969, represented only 24% of all such references, outnumbered 2 to 1 by positive references. Articles referring to foreign business developments or foreign trade in computers appeared only in the periods 1950-1954 (in 5% of all articles), 1960-1964 (in 3% of all articles), and 1965-1969 (10% of all articles).

All three types of references involving comparisons between computers and humans -- references to the limitations, advantages, or similarities of computers versus human beings -- also decreased rather steadily over the time period examined. Except for the period from 1945-1949, more articles in each five

year period mentioned the computer's advantages over human beings -- in speed, accuracy, stamina, cost, and so on -- than their comparative limitations (lack of creativity, inability to really think, etc.). The proportion of all articles referring to problems related to or raised by computers reached a high point in 1965-1969, when 25% of all articles included references to this topic.

With some fluctuation from one 5-year period to the next, mentions of both the size and cost of computers generally decreased in frequency over time. One of the two articles from 1940-1944 and 67% of all those appearing during 1945-1949 included references to the size of computers, most of which stressed their large size, while only 10% of those for 1965-1969 included such references, 8 out of 10 of which stressed how small computers were. Similarly, mentions of the cost of computers fell from a high of 26% of all articles in 1950-1954 to a low of 7% in 1965-1969, and the emphasis changed from high costs to both low and varied costs.

Predictions about the social impact of computers were made in 17% to 27% of all articles over the time period studied. Except for the last five-year period examined, 1965-1969, references to predicted social outcomes of a clearly negative nature, like increased unemployment, devaluation of human brainpower, and loss of privacy, either outnumbered or equaled references to positive social outcomes, such as improvements in medicine, increased

jobs, greater efficiency in manufacturing, or the solution of social problems. A large percentage of the negative social predictions were attributed to Norbert Wiener, the cybernetician, who was the most frequently cited expert source on the role of computers in society.

Terms and Anthrophomorphic Analogies

The number of different terms used to refer to the computer decreased from 1943 through 1969, as a growing percentage of all articles settled on the term "computer" as their only label for the technological devices in question. When the term "computer" was initially used, it was usually qualified by the adjectives "mechanical," "electromechanical," or "electronic," to distinguish it from the human mathematicians working on ballistics calculations for the military, who were also called "computers." While we now think of computers, calculators, and robots as somewhat distinct categories of machines, these terms were initially used interchangeably, along with "brain," "thinking machine," "computing machine," the generic term "machine," and even the term "monster." "Calculator" was the term used in most of the articles examined through 1949, after which it was replaced by the term "computer" as the most frequent label. Nevertheless, the Readers Guide continued to index all articles about what we would now refer to as "computers" under

the category "calculating machines" through 1964, when it switched to the heading "computers." Yet, even as late as 1965-1969, 7% of all articles about "computers" still referred to them as "brains," and 5% as "robots."

Anthropomorphic similes and metaphors describing computers were used sporadically throughout the time period studied. Some of these figures of speech compared computers to children, but most seemed to refer to adults. In the few cases where gender was apparent, all but two of the references indicated that computers were male. Several examples should illustrate the tenor of these descriptions:

> "...giant calculating machines which eat up equations as quickly as small boys gobble peanuts." (Time, 1947)
>
> "Whining like a spoiled child, the machine went about its work." (Newsweek, 1949)
>
> "On Oxford Street, in Cambridge, Mass., lives a sibyl, a priestess of science...Her name is Bessie; she is a long, slim, glass-sided machine with 760,000 parts...Bessie is a progenetrix, a sort of mechanical Eve." (Time, 1950)
>
> "The student put to the test at the University of Illinois was 8 1/2 feet tall, 10 feet wide at the shoulders, and packed with green-faced cathode-ray tubes and little red neon lights." (Time, 1952)
>
> "MANIAC, oddly enough, is the nickname of one of the world's most impressive thinkers...MANIAC, now 9, is constantly showing how it can be an ever more useful member of adult scientific society." (Newsweek, 1955)
>
> "But what first struck me was that the electronic brain didn't seem at all snobbish. It settled down to a game of blackjack like a regular fellow, ribbed you when you went bust, encouraged you to have another try. Now and again, it gave out with an iron chuckle, simmered thoughtfully, cackled, and dealt another

hand...I had the feeling that under the proper circumstances the machine would not be averse to a beer and a few saucy jokes." (Life, 1962)

"All night long she clicked and clacked wildly, and as dawn approached she was whirring angrily and gnashing her gear teeth in frustration. Finally she blew her tubes and fuses and collapsed in shock." (Readers Digest, 1963)

DISCUSSION

The content of the magazine articles described above cannot be viewed simply as a direct reflection of actual developments in the "real world." As numerous communication researchers have documented (e.g., Funkhouser, 1973), the content of news reports bears little relationship to the relative frequencies of the events covered in such reports, as measured by Census data or other official statistics. One reason for this discrepancy is that journalists' definitions of what is important are not based solely on the frequency or typicality of events. In addition, journalists seek to write not only about important events but also about events that are judged to be interesting. Accordingly, occurrences that are unusual and atypical, even bizarre, may be reported as often as those that are the most typical, frequent, or significant (Gans, 1979). In this regard, one might note how unlikely it is that the frequency of magazine references to the use of computers to create concordances for the Bible or to write poetry or compose music, as documented in this

study, reflected the actual proportion of computer applications devoted to these uses at the time. Similarly, the shift from the military to educational institutions as the most frequently mentioned locus of computer use by the end of the 20-year period examined may not be an accurate indication of the most frequent sites for the application of computer technology over the course of time but may instead reflect the news media's search for different and interesting "angles" for computer stories. Thus, to the extent that one might wish to consider the content analyzed above as a reflection of reality, one must view it as a selective and distorted reflection and one capable of having its own impact on readers' beliefs and conceptions, regardless of "real-life" developments.

Gans (1979) has described what he discerns as the "enduring values" that have shaped and been implicitly reflected in news content over the years. Among these values have been a nostalgic preference for rural, anti-industrial environments and lifestyles, for nature versus artificiality, for smallness versus bigness, and a high regard for individualism. News stories tend to treat negatively anything that might be seen as a threat to individual freedom and privacy, or indicative of control by forces too large and impersonal to notice or value the individual.

> "Consequently, the news often contains stories about new technology that endangers the individual -- notably the computer, which is viewed anthropomorphically, either as a robot that will deprive human beings of

> control over their own lives or as a machine endowed with human failings, which is therefore less of a threat. In any case, there is always room for a gleeful story about computers that break down." (Gans, 1979, p.49)

Much of Gans' description of the treatment of computers in the news would seem to fit the content of the magazine articles examined in this study. For example, during most of the time period studied, references to the computer's superiority to human beings outnumbered those to the computer's comparative weaknesses. Yet, despite their apparent superiority, computers were found to be increasingly prone to breakdowns and errors, as indicated by the rise in references to computer-related problems. And negative predictions about the computer's likely impact on society were usually reported as often as or more often than predictions about its likely positive effects.

That computers should be compared to human beings at all is a matter worthy of note in itself. Explicit comparisons between the capabilities of computers and humans were supplemented by occasional anthropomorphic descriptions, some of which stressed the computers' huge size and awesome powers, while others pointed out their all-too-human foibles. References to computers as "brains," found in many of the articles examined throughout the 20 years studied, also comprised a form of anthrophomorphism, or at least animism. While understandable as either an attempt to comprehend something new and different by likening it to something familiar or as an effort to dramatize mass media

coverage of the computer and thus make it more interesting to the reader, it would seem that these instances of anthropomorphism also reflected the suspicion that computers were capable of having independent drives, motives, and initiative, and could serve as competitors and replacements for humans. Such references could only reinforce people's misconceptions about the nature of computers and their fear of this new technology.

In this regard, the preponderance of analogies to male rather than female humans is noteworthy, especially when one considers how often other technological devices, like the automobile, have usually been referred to as "she." The choice of the male gender in this case could reflect and thus reinforce the conception of computers as powerful, independent beings, not under human control (while the more female automobiles obediently follow orders). As for the two examples of female analogies that were found, one depicted the computer as a priestess and mother, while the other described a computer having a nervous breakdown.

The content of mass media reports about the computer from 1943 through 1969, as indicated in this study of popular magazine articles, may become clearer and more meaningful when placed within the context of a forthcoming analysis of articles published during the subsequent decade and a half. It will be interesting to see, for example, whether anthropomorphic analogies become less frequent as the size of computers continues to decrease and as they enter the home. It may be that analogies

to humans will be replaced with analogies to small animals, that is, "pets," or that female characteristics are more frequently applied to computers as they become increasingly domesticated and "user-friendly."

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